Oct. 1, 1946. S. S. STEVENS 2,408,490

EARPHONE SOCKET

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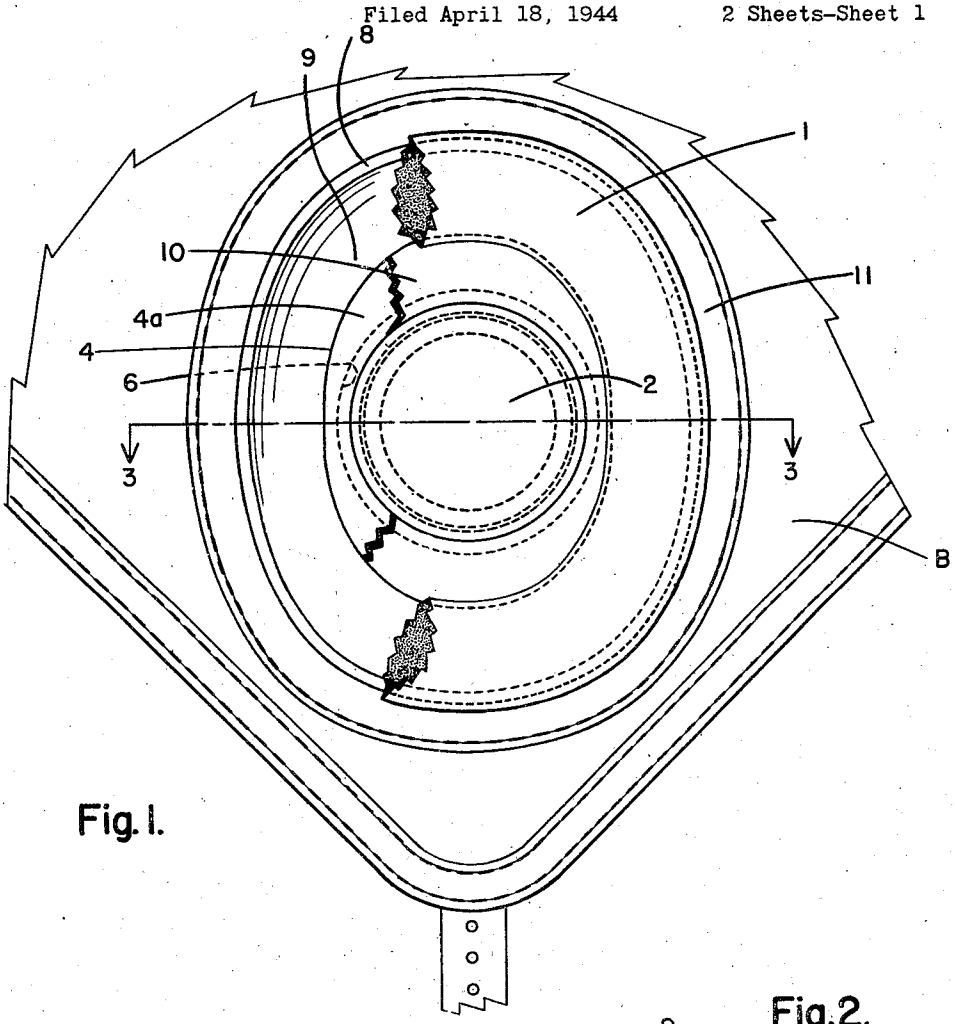


Fig. 1.

Fig. 2.

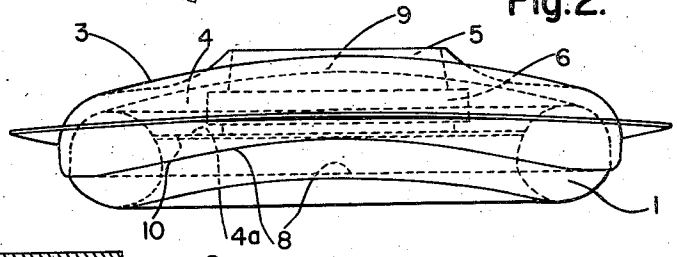
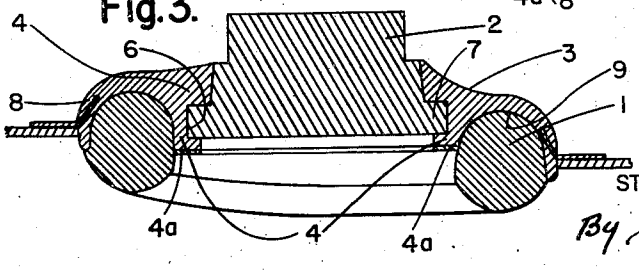


Fig. 3.



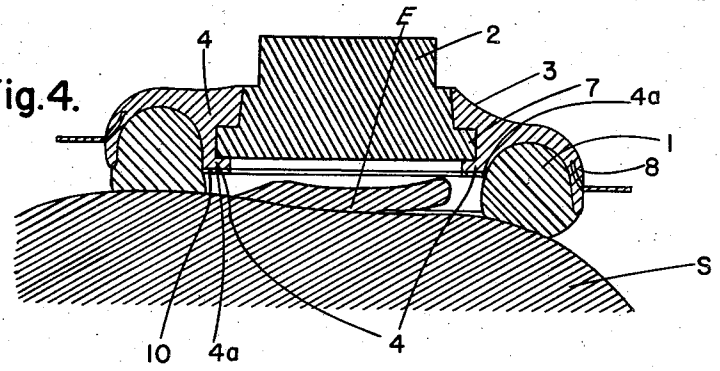
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Fig.4.



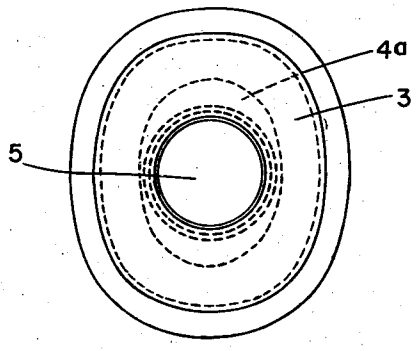


Fig.5.

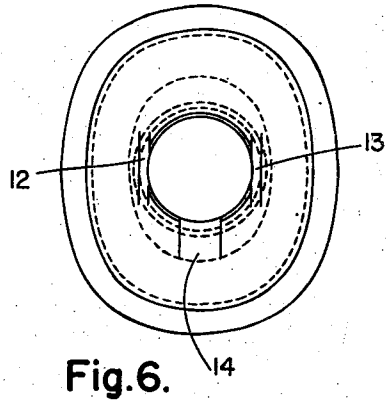


Fig.6.

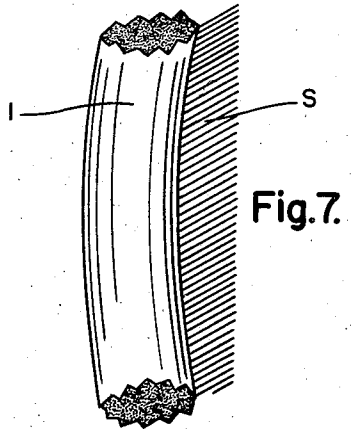


Fig.7.

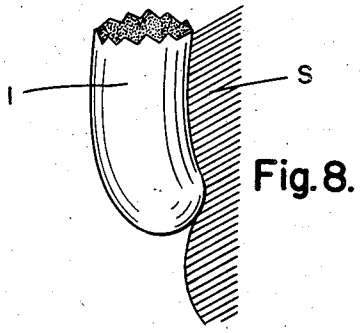


Fig.8.

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EARPHONE SOCKET

Stanley Smith Stevens, Cambridge, Mass., assignor to the United States of America, represented by the Executive Secretary of the Office of Scientific Research and Development

Application April 18, 1944, Serial No. 531,684

3 Claims. (Cl. 179—156)

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This invention relates to sound control devices and more particularly to an earphone and socket assembly for use with aviation helmets, headsets and the like.

A customary practice has been to mount earphones in an aviation helmet and to utilize chin straps to press the earphones firmly against the ears in an effort to exclude ambient noise from passing around the earphone into the ear canal. This arrangement has not been satisfactory. Continuous pressure of the earphones against the ears may give rise to considerable discomfort and in addition the earphone is never completely sealed around the outer ear. Intense noise such as is developed in the operation of modern aircraft may enter the ear canal and become painful and may render substantially unintelligible signals received from a radio or interphone.

To surmount these difficulties, it has been proposed to surround the earphone, at the inner side of the helmet, with a member which is commonly referred to, in the art, as a "doughnut." This member essentially consists of a sealing member of annular cross section, formed of a relatively soft yieldable material whose function in part is to serve as a spacing member for supporting the earphone immediately adjacent to the outer ear without compacting the ear against the skull. The sealing member comprises an acoustic sealing means which may be firmly pressed against the skull by the chin straps without discomfort, thus tending to exclude sound from passing between the sealing member and the skull. The sealing member and earphone assembly has been successful in providing greater comfort and some improvement in sound attenuation. There remains the objection, however, that ambient noise may pass between the earphone and the sealing member as well as through the sealing member itself, in either case leaving the ear canal relatively unprotected.

It is an object of the invention therefore to provide an improved sound control device for earphones, and to devise an earphone support or socket in which are incorporated sound attenuating means directed to overcoming the difficulties above noted, and to providing a combined sound insulating and sealing effect. It is also an object of the invention to provide a simple, cheap and efficient device of the character referred to, which is conveniently attached to an aviation helmet and which avoids interference with the normal use of the helmet.

The nature of the invention and its objects will be more readily understood from the following description of the drawings and discussion relating thereto.

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In the accompanying drawings:

Fig. 1 is a view in elevation illustrating the socket of the invention mounted at the inner side of an aviation helmet which has been diagrammatically indicated;

Fig. 2 is a view in side elevation of the socket;

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a horizontal cross section diagrammatically illustrating a skull and ear, with the socket of the invention being indicated in an operative position at the side of the skull;

Fig. 5 is an elevational view of the outer side of the socket;

Fig. 6 is an elevational view illustrating a modification of socket;

Fig. 7 is a detail view diagrammatically illustrating a skull and indicating the position assumed by the sealing member of the invention as it contacts the side of the skull; and

Fig. 8 is a detail view diagrammaticaly illustrating a skull and indicating the position assumed by the sealing member at another point of contact with the skull.

The invention in general provides for a holder or socket in which both an earphone and a sealing member, of the "doughnut" type, may be mounted. The socket is made of sound insulating material, and designed to extend between the earphone and the sealing member and to overlie a substantial part of the sealing member itself. The socket is also formed so as to provide for a rearrangement of the sealing member and the earphone, relative to the skull and ear respectively, thereby further increasing the efficiency of the earphone and sealing member.

Referring more in detail to the drawings, numeral 1 denotes a sealing member or "doughnut" of the type already referred to (Fig. 1). This member consists of a continuous ring of annular cross section which may, for example, comprise a casing of chamois, stuffed with a soft yieldable material such as kapok. Sponge rubber and fibrous materials are also used in making the sealing member. By reason of its yieldable character, the sealing member is particularly adapted to be pressed firmly against the skull, thus providing an acoustical seal around the outer ear. The sealing member 1, when used with the socket of the invention, also includes improved features which will be later described.

Numeral 2 refers to an earphone of conventional type employed in aviation helmets, and is

intended to be illustrative of various other forms of earphones which may be desired to be employed. Numeral 3 denotes a holder or socket which supports the earphone and sealing member 1 in spaced apart relation. The socket is formed of a sound-insulating material such as rubber, and preferably consists of a cuplike member somewhat oval in outline (Fig. 1). When mounted in an aviation helmet B, the socket 3 presents an inner side against which the sealing member 1 is secured as shown in Fig. 1, and an outer side from which the earphone 2 projects, as may be more readily seen in Fig. 4.

At its inner side, the socket is formed with a central body portion 4 which is relatively thicker than other portions of the socket and which presents a flat surface 4a. Numeral 5 denotes an earphone opening extending through the body portion 4. The edge of the opening 5 may if desired be beveled as shown in Fig. 2, to facilitate engagement of the socket with the earphone 2. The earphone 2 occurs in a somewhat recessed position relative to those peripheral portions of the sealing member 1 which are to engage against the skull. At points between the inner and outer sides of the socket 3 and adjacent to the opening 5, the body portion 4 has been formed with a channel 6, which is adapted to receive a rib 7 on the outer periphery of the earphone 2.

The central body portion 4 occupies the space between the outer periphery of the earphone 2 and the inner periphery of the sealing member 1, as may be seen from an inspection of Figs. 1 and 3, and by reason of its thickness, the body portion provides a relatively heavy mass of sound insulation which is effective in attenuating the passage of sound between the earphone and the sealing member.

The outer peripheral portions of the socket 3 are curved around the sealing member 1 to provide a lip or rim 8 which, at its inner side, conforms to the contour of the sealing member and presents a groove 9 surrounding the body portion 4. The groove 9 provides a seating in which the sealing member may be conveniently secured by the use of an adhesive material. By allowing the socket to extend across the overlie the sealing member in the manner described, a second important sound insulating effect is obtained, namely insulation of the sealing member itself. Since the sealing member represents a certain amount of mass, the relatively thin tapering rim 8 is sufficient to provide the required insulating material.

Relative to a plane passing through the flat face 4a of the body portion 4, the groove 9 extends more deeply throughout the front half of the socket than throughout its rear half. The term "front half" refers to that portion of the socket which in use occurs substantially in front of the ear, and correspondingly the term "rear half" refers to the socket portion occurring substantially in back of the ear. As viewed in Figs. 1, 3 and 4, the socket member has its front half occurring at the left-hand side of the figures. In addition, the groove 9, with respect to the reference plane noted, begins to change in depth as it extends around the front half of the socket and gradually deepens until it reaches its greatest depth at a point approximately halfway around the front half.

As a result of the variation in the groove 9, the outer side of socket presents a slightly convex surface at its front half and a slightly concaved surface throughout its rear half as illustrated in Fig. 4. There is thus provided a thickness of material, directly over the sealing member 1, which is substantially uniform throughout both the front half and rear half of the socket.

The rim 8, in relation to the reference plane of the face 4a, also changes in height and as it extends around the front half of the socket gradually decreases to a low point corresponding to the point of greatest depth of the groove 9.

The irregularity in depth of the groove 9 provides for an offset arrangement of the sealing member 1 in relation to the reference plane passing through the face 4a. By supporting the sealing member more deeply throughout the front half of the socket, than throughout the rear half, the corresponding front half of the earphone 2 is brought substantially nearer to the contacting surface of the sealing member than the rear half of the earphone. When the socket assembly is placed over an ear E, as diagrammatically illustrated in Fig. 4, the earphone in relation to the skull S will be spaced away a greater distance at its rear half than at its front half. An immediate result of this asymmetrical arrangement of the earphone with respect to the sealing member is to allow the inner surface of the earphone 2 to be placed in a position in which it closely conforms to the natural angle of projection of the outer ear and reduces the space between the earphone and the ear canal.

It is of importance in the acoustic performance of this device that the volume of air between the earphone and the ear canal be reduced to a minimum. A relatively small volume of air between the earphone and the ear canal tends to render a signal received from the earphone more intense, since for the available sound energy in the signal there is less air to be activated. The offset relation of the earphone with respect to the sealing member accomplishes a desirable reduction in the volume of air. The offset relation further allows the face of the earphone to come into the closest possible contact with the outer ear, while still allowing the sealing member to maintain its spacing function so that the outer ear is not compacted against the skull, and so that the discomfort consequent upon such compaction is avoided.

The variation in the depth of groove 9 and height of rim 8 furnishes still other beneficial results by reshaping the contacting surface of the sealing member 1. As may be more clearly seen in Fig. 2, the socket imparts to the contacting surface of the sealing member 1 throughout its front half, a slight concavity. When the socket is in use, this concavity allows the sealing member to overlie and conform to the raised part of the skull S occurring directly in front of the outer ear at the cheek bone, and provide an improved seal, as is diagrammatically shown in Fig. 5. At the same time the lower part of the sealing member, due to the concavity, tends to conform to and fill in the space immediately below the outer ear at the mastoid process, as has been diagrammatically illustrated in Fig. 8.

By thus rearranging the shape of the sealing member, a more complete acoustical sealing is achieved at the hollow above the cheek bone and the hollow at the mastoid process, so that with a given pressure, a substantially uniform sealing effect is obtained all the way around the skull, and any possible source of sound penetration at these points is largely eliminated. It should also be noted that the decreased edge of the rim 8 at the front edge of the socket permits the doughnut to be more closely pressed against the

skull in the offset relation described without there occurring any tendency for the rim 8 to bear against the skull and cause discomfort.

10 denotes a protecting lining which may, for example, consist of chamois, disposed over the inner side of the socket and is particularly adapted to cover the body portion 4 to prevent this material from coming into direct contact with the outer ear. In this connection, it is pointed out that either from the point of view of protecting the outer ear from contacting a cold rubber surface during low-temperature flying conditions, or from the point of view of toxicity from the contact of the outer ear with the insulating material, the protecting lining is particularly desirable.

The invention also includes a stitching flap 11 formed of some suitable material such as a rubberized fabric, which is preferably molded in the socket. This member is adapted to be stitched to the inner surface of a helmet for attaching the socket member therein. Such a mode of attachment is adapted for use with most forms of helmets and is intended to be illustrative of various other fastening means.

In assembling the earphone assembly in a helmet, the flap 11 is stitched at the border of a hole cut into the helmet to permit the earphone to project outwardly therefrom (Fig. 1). The socket member is positioned so as to naturally surround the outer ear with the front edge of the socket occurring substantially vertical. It should be noted that the socket may be used either for a left or a right ear by simply turning it end for end, thus effecting substantial saving in manufacture. In operation, the helmet is adjusted over the head in the usual manner with the sealing members at either side fitting over the outer ears and engaging against the sides of the head. Thereafter the chin straps of the helmet are fastened together with a light pressure being exerted on the sealing members, enabling these members to provide a seal against the head at all points around the ears.

In Fig. 6 I have shown a modification of the invention for use with a headband in which the outer side of the socket 3 is formed with slots 12 and 13. The slots 12 and 13 are cut into the socket to provide a means of engaging the extremities of a headband yoke where it may be desired to use the socket with this type of equipment. The slot 14 is provided to admit electrical connections. It may also be desired to employ the socket with other types of equipment.

The socket may be modified in various ways. For example, it may be constructed in two or more pieces and may be formed of two or more types of insulating material. Various other changes in the shape and design of the socket may also be desired to be carried out.

Considering the various advantages derived from the structure of the invention, it will be seen that the socket constitutes a convenient member for supporting both the earphone and the sealing member. The opening and channelled edge furnish a simple and efficient means of releasably holding the earphone. The combined sound insulating and sealing effects noted in connection with the description of the socket remove all disadvantages of the earphone and doughnut type of assembly without in any way causing discomfort or interfering with the use of goggles and other equipment over the helmet. The socket is a simple efficient unitary member capable of being easily and cheaply molded on a quantity basis.

While I have shown a preferred embodiment of the invention, it should be understood that various changes and modifications may be resorted to, in keeping with the spirit of the invention as outlined by the appended claims.

Having thus described the invention, what I claim is:

1. As an article of manufacture a sound control device comprising an earphone, a socket member having the earphone centrally supported therein, a sealing ring of yieldable material mounted in a groove in the inner side of the socket in spaced relation to the earphone, said socket including a relatively thick body portion of sound insulating material occupying the space between the earphone and the sealing ring and adapted to provide sound insulation therein, said socket having outer peripheral portions overlying and extending around the sealing ring to form a rim, the outer peripheral portions of the socket adapted to provide a sound insulating material for the sealing ring, said groove extending more deeply into the socket at the front half thereof than at its rear half to arrange the sealing ring in offset relation with respect to the earphone, a stitching flap secured to socket adjacent the outside of said rim, said flap adapted to be stitched to the inside of a helmet for the purpose of installing the socket assembly therein.

2. As an article of manufacture a socket for an earphone and sealing ring assembly, said socket consisting of a cup-like member of sound attenuating material in which is centrally formed an opening for receiving and supporting an earphone, said socket being formed at its inner side with a groove extending around the said opening in spaced relation thereto, a sealing member of soft yieldable material mounted in the groove, said socket presenting a relatively thick body portion which occupies the space between the opening and the said groove, said body portion adapted to provide a sound insulating medium, said socket having outer peripheral portions extending across and overlapping the sealing member to further provide a rim, said outer peripheral portions and rim constituting sound insulation for the sealing member.

3. As an article of manufacture a sound control device comprising an earphone, a socket member having the earphone centrally supported therein, a sealing ring mounted at the inner side of the socket in spaced relation to the earphone, said socket consisting of a cup-like member of insulating material extending across and overlying the sealing ring, said sealing ring being embedded more deeply at one side of the socket than the other.

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